

What is claimed is:

1. A plasma generator comprising:

an electrode part constituted of plural electrodes;

a charge storage part connected with the electrode part in series for storing charge, and

an AC power source for applying AC voltage to a serial connection circuit formed of the electrode part and the charge storage part,

wherein by applying the AC voltage to the serial connection circuit formed of the electrode part and the charge storage part by the AC power source, discharge is intermittently caused in each inter-electrodes of the plural electrodes of the electrode part, and plasma is thereby generated.

2. An ozone generator, comprising:

an electrode part constituted of plural electrodes;

a charge storage part connected with the electrode part in series, for storing charge; and

an AC power source for applying AC voltage to a serial connection circuit formed of the electrode part and the charge storage part,

wherein by applying the AC voltage to the serial connection circuit formed of the electrode part and the charge storage part by the AC power source, discharge is caused intermittently in each inter-electrodes of the plural

electrodes of the electrode part, and ozone is generated by supplying gas containing oxygen atom in the discharge atmosphere.

3. A plasma generator, comprising:

an electrode unit constituted of a first electrode, an insulating material or a dielectric material provided around the first electrode, and a second electrode provided around the insulating material or the dielectric material;

a third electrode facing the first electrode; and

a power source for applying voltage between the second electrode and the third electrode,

wherein by the power source, the voltage is applied between the second electrode and the third electrode, discharge is thereby caused between the first electrode and the third electrode, and plasma is thereby generated.

4. The plasma generator according to claim 3, wherein a charge storage part for storing charge is formed by the first electrode and the second electrode, with the insulating material or the dielectric material interposed between the first electrode and the second electrode.

5. The plasma generator according to claim 3, wherein by applying AC voltage between the second electrode and the third electrode, a pulse discharge is caused between the first

electrode and the third electrode, and plasma is thereby intermittently generated.

6. The plasma generator according to claim 3, wherein the plasma is generated in an atmospheric pressure.

7. The plasma generator according to claim 3, wherein the electrode unit is provided in plural numbers.

8. The plasma generator according to claim 3, wherein the electrode unit is provided in plural numbers around the third electrode.

9. The plasma generator according to claim 3, wherein a protrusion portion or a recess portion or an opening hole is provided in a part of the third electrode faced with the first electrode.

10. The plasma generator according to claim 3, wherein the first electrode is formed in a bar-shape.

11. The plasma generator according to claim 3, wherein the first electrode is formed in a cylinder-shape.

12. The plasma generator according to claim 3, wherein the insulating material or the dielectric material, or/and the

second electrode are formed in a cylinder shape.

13. The plasma generator according to claim 3, wherein at least the first electrode or/and the third electrode are made of metal.

14. The plasma generator according to claim 3, wherein the first electrode or/and the third electrode are cooled by refrigerant.

15. A substrate processing apparatus, comprising:  
an electrode unit constituted of a first electrode, an insulating material or a dielectric material provided around the first electrode, and a second electrode provided around the insulating material or the dielectric material;

a third electrode facing the first electrode; and

a power source for applying voltage between the second electrode and the third electrode,

wherein by the power source, the voltage is applied between the second electrode and the third electrode, discharge is thereby caused between the first electrode and the third electrode, and in this discharge atmosphere, gas containing oxygen atom is supplied, and ozone is thereby generated.

16. A substrate processing apparatus, comprising:

a processing chamber for processing a substrate; and  
a plasma generator for generating plasma,

wherein the substrate is processed by using a reactant  
obtained by exposing a processing gas to the plasma generated  
by the plasma generator,

the plasma generator comprising:

an electrode unit constituted of a first electrode,  
an insulating material or a dielectric material provided  
around the first electrode, and a second electrode provided  
around the insulating material or the dielectric material;

a third electrode facing the first electrode; and

a power source for applying voltage between the second  
electrode and the third electrode, wherein by applying the  
voltage between the second electrode and the third electrode,  
discharge is caused between the first electrode and the third  
electrode, and plasma is thereby generated.

17. A substrate processing apparatus, comprising:

a processing chamber for processing a substrate; and  
an ozone generator for generating ozone,

wherein by using the ozone generated by the ozone  
generator, the substrate is processed,

the ozone generator comprising:

an electrode unit constituted of a first electrode, an  
insulating material or a dielectric material provided around  
the first electrode, and a second electrode provided around

the insulating material or the dielectric material;

a third electrode facing the first electrode; and

a power source for applying voltage between the second electrode and the third electrode,

wherein by applying the voltage between the second electrode and the third electrode, discharge is caused between the first electrode and the third electrode, and in such a discharge atmosphere, gas containing oxygen atom is supplied, and ozone is thereby generated.

18. A method of manufacturing a semiconductor device, with a plasma generator having an electrode unit constituted of a first electrode, an insulating material or a dielectric material provided around the first electrode, and a second electrode provided around the insulating material or the dielectric material, and a third electrode facing the first electrode,

the method comprising the steps of:

generating plasma by causing discharge between the first electrode and the third electrode by applying voltage between the second electrode and the third electrode; and

processing a substrate by using a reactant obtained by exposing a processing gas to the plasma thus generated.

19. The method of manufacturing the semiconductor device according to claim 18, wherein a pulse discharge is

caused between the first electrode and the third electrode by applying AC voltage between the second electrode and the third electrode, and plasma is thereby intermittently generated in the plasma generating step.

20. The method of manufacturing the semiconductor device according to claim 18, wherein the substrate is processed in the substrate processing step by using ozone obtained by exposing gas containing oxygen atom to atmosphere where the discharge is caused.

21. A plasma generator, comprising:

an electrode part constituted of plural electrodes;

plural charge storage parts connected in series to the electrode part to store charge; and

an AC power source for applying AC voltage to a circuit in which the plural serial connection parts formed of the electrode part and the plural charge storage parts are connected in parallel,

wherein by applying the AC voltage by this AC power source to the circuit in which the serial connection part formed of the electrode part and the plural charge storage parts are connected in parallel, discharge is intermittently caused between plural electrodes of the electrode part, and plasma is thereby generated.